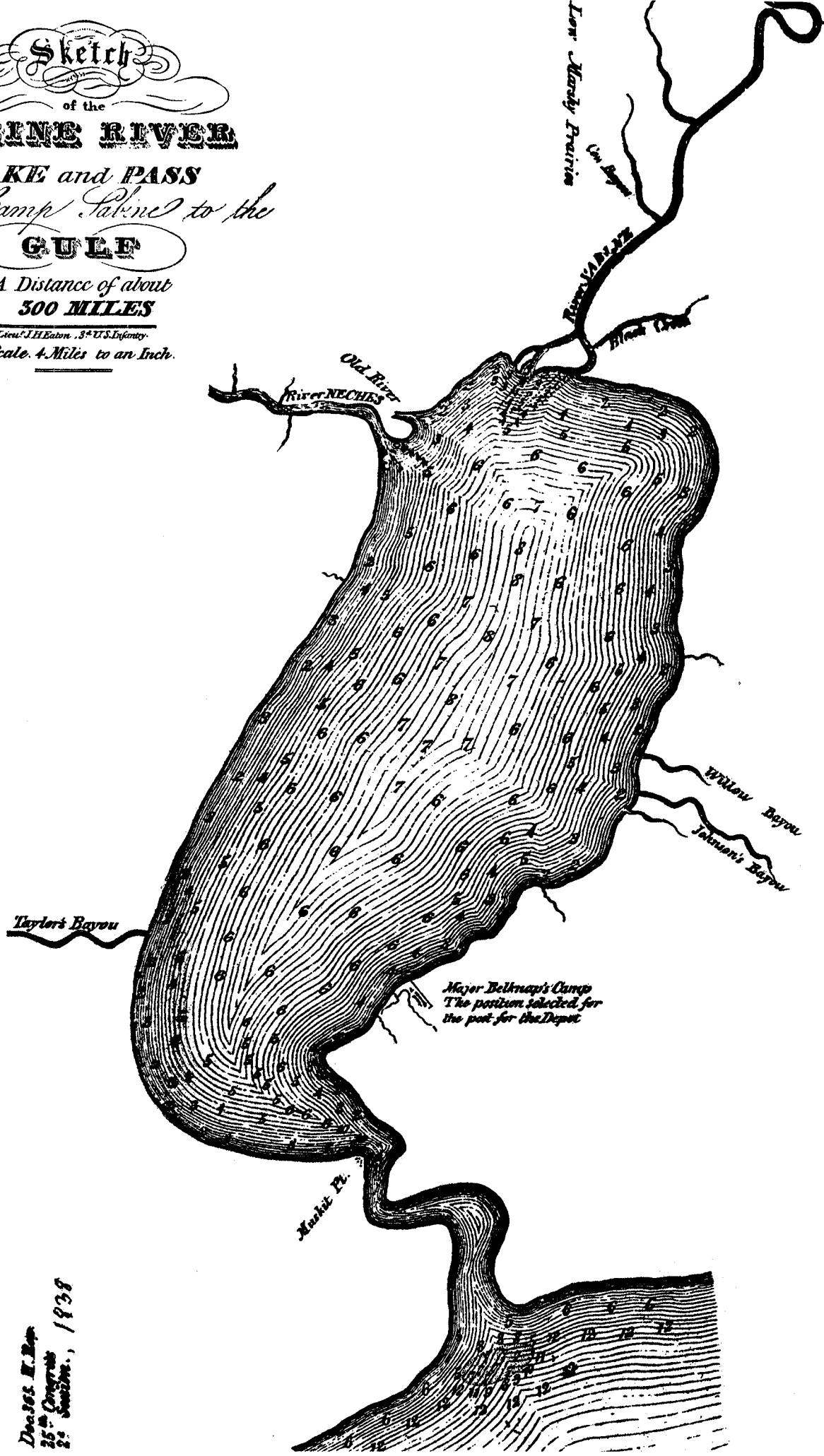
Sketch
of the
SABINE RIVER
LAKE and PASS
from Camp Sabine to the
GULF
A Distance of about
300 MILES

Lieut.t J.H Eaton .3d U.S.Infantry.

Scale. 4 Miles to an Inch.



Doc. No. E. Rep.
25th Congress
2d Session.
1838

3

Transformation of the Sabine

The Sabine River flows along the eastern border of Texas, joining the waters of the more westerly Neches River in Sabine Lake. Assigned to the Galveston District continuously for more than the last half century, these rivers changed hands a number of times in prior years and their early development involved several army engineer districts. The Sabine-Neches Waterway ranks unique among Galveston District channels in many respects, but particularly in that other districts accomplished its deep-draft conversion. Nevertheless, this waterway has received substantial improvement by the Galveston engineers and its story properly belongs in this district's history. Preceding the other streams in Texas as United States territory, the Sabine River was the first to be examined by army engineer officers.

The Disputed Boundary

At the time of the Louisiana Purchase in 1803, the valuable area known today as the Texas Coast was considered of such meager significance that the treaty failed to specify precisely the southwestern boundary; President Thomas Jefferson was prompted to wonder whether the newly acquired territory extended to the Sabine River or to the Rio Grande. Since neither Spain nor the young United States was prepared to defend Texas, the coast passed the next sixteen years largely unclaimed except by privateers and renegades.[1]

An indirect report suggests how little the engineers knew of Texas geography as late as 1838. Early that year, under the command of Maj. W. G. Belknap, an expedition of the Third Infantry camped on the southwest bank of Sabine Lake and removed a raft which had obstructed navigation on the Sabine River. According to Isaac Wright, captain of the steamboat *Velocipede,* the result was "success beyond the expectations of the oldest inhabitants of the river," enhancing the value of "all lands adjacent to the river at least two hundred per cent." This improvement enabled Captain Wright to navigate the river 300 miles inland to Camp Sabine and back without injury to his boat, which carried 143 tons and

Opposite page: Lower portion of Lieutenant Eaton's drawing of Sabine River, Lake, and Pass, 1838

drew 5 feet of water. He estimated that freight from Natchitoches to Camp Sabine, previously costing five or six cents per pound, would be reduced to a mere two cents per pound for the longer journey from New Orleans to Camp Sabine via the newly opened Sabine River route.[2]

Lt. J. H. Eaton of the Third Infantry sketched the river from Camp Sabine to the Gulf of Mexico. Transmitting this drawing along with his report to his commander in Washington, Major Belknap noted:

> The chart of the lake and pass you will find to be somewhat different from the one furnished me from the Engineer department. This, however, is correct . . . . made . . . after a most careful and minute examination.[3]

Presumably, the "erroneous" Engineer Department chart was one of the maps, compiled in department headquarters, which incorporated all available information and existing knowledge. Held by Spain until 1821, Mexico until 1836, and the Texas Republic until statehood in 1845, Texas had little opportunity to receive direct scrutiny by the army engineers. Questions over the boundary would change this, however, and topographical engineers would soon be called in to view the region firsthand.

As control of Texas passed through successive governments, the Sabine River boundary grew into a chronic muddle. When Louisiana assumed statehood in 1812, its western boundary was described as the middle of the river, including all islands. Problems arose for the United States, first with Spain, next with Mexico, then with the Texas Republic, and still later with the states of Texas and Louisiana. An 1819 treaty between the United States and Spain fixed the boundary along the western bank of the Sabine River from the Gulf to the thirty-second parallel north, continuing due north to the Red River which it followed west to the one hundredth meridian. This boundary, however, failed to definitively resolve the issue.[4]

The Spanish treaty was succeeded by a new treaty, executed between the United States and Mexico on January 12, 1828. This treaty was considered binding upon Texas after the Republic declared its independence from Mexico. In 1839, a joint Texas-United States commission was appointed to survey the boundary between these two nations. Maj. James D. Graham was assigned to satisfy the desire of President Martin Van Buren

> . . . that the commission should have the benefit of the advice and assistance of an officer of the United States corps of

> Topographical Engineers, skilled in the science of astronomy and surveying.[5]

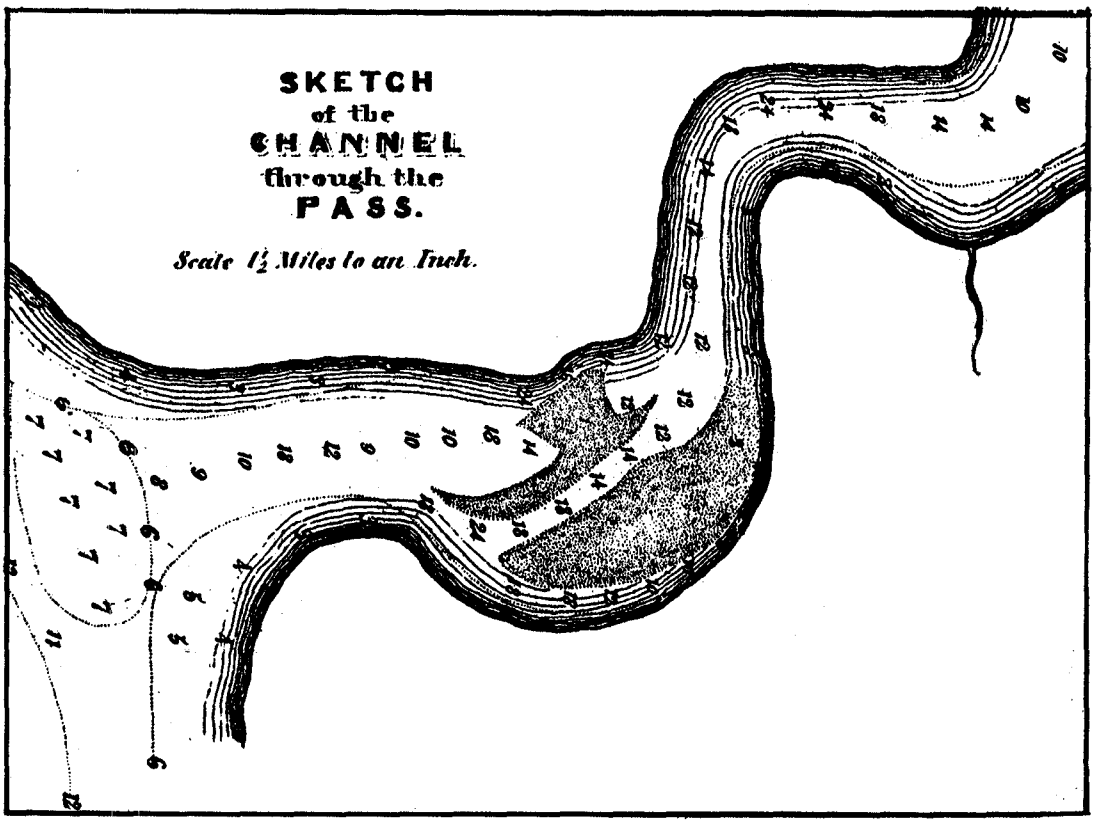
Major Graham, Lt. Col. James Kearney, and other topographical engineer assistants conducted this survey between May, 1840 and June, 1841. Pretensions of the United States to move its boundary west to the Neches River were quickly squelched. Considerably more controversy was generated over interpretation of the treaty specification, "The boundary line shall begin on the Gulf of Mexico, at the mouth of the river Sabine, in the sea. . . ." The final commission report established the boundary along the western bank of the river from the point where it entered the Gulf (latitude 29°41'27".5 north) to latitude 32°.[6]

This boundary remained unchanged until 1848 when Congress allowed the new state of Texas to extend its eastern boundary from the west bank to the middle of the Sabine. Subsequently, ownership of islands in the river grew into a stickier issue. With an estimated $1 billion at stake in the oil-rich river bottoms, Texas finally brought its case to the U.S. Supreme Court to establish its claim to the geographic middle of the Sabine.[7]

A decision handed down on March 30, 1973 confirmed the boundary along the geographic middle, but sidestepped the issue of island ownership. While conceding that Louisiana owned all islands in the eastern half of the river, the court withheld judgment regarding those in the western half.[8] Further proceedings must determine United States claims to these islands and settle the question of which islands existed before, or were created after, 1812. As the agency most responsible for modifying the river, the Corps of Engineers has been asked to furnish evidence in the recent proceedings.

Early Harbor Improvements

Annexation of Texas brought the state's navigable streams into the province of the army engineers. Lt. Henry L. Smith, under orders from New Orleans, surveyed the Sabine River in 1853. He found the adjacent country abundant with "wild game, such as ducks, geese, wild turkeys, deer, and bears" and blessed with good soil which "produces fine crops of cotton, corn, potatoes, &c." Shoaling, narrowing, and snags in the river presented such hazards to navigation that the "more tedious, but more certain" route via the Red River was preferred for transporting the region's cotton. Smith was informed that much of the lumber that supplied a large portion of Texas had traveled down the Sabine River, but the obstructions he noted would make difficult descent of the rafts. He recommended improvements to permit navigation along the river's lower 178



Sabine Pass as drawn by Eaton in 1838

miles year-round and along its total 738-mile length for seven months of the year.[9]

In Sabine Harbor, Smith found a tortuous channel; he proposed dredging a new, more direct channel 9 feet deep. Although the bar at the entrance to Sabine Pass had little more than a 5-foot depth at low water, its soft mud composition rendered it a less formidable obstruction than other bars along the coast and one which "a steamship can readily pass drawing ten feet." He advised no improvement of this bar.[10]

Twenty years later, Lt. H. M. Adams concurred after resurveying the bar and the pass under Captain Howell's direction. He found the channel across the soft mud bar 6 to 6½ feet deep. In 1875, however, Howell advised dredging it to at least 12 feet. A $20,000 appropriation began an expenditure exceeding $160,000 on dredging operations from 1875 to 1881. The U.S. dredge *Essayons*, assigned to the New Orleans Engineer Office, was put to work at the pass in 1877. She had about half completed a channel 12 to 15 feet deep when her boilers went out and she was laid up for repairs. Meanwhile, the *McAlester* was scheduled to carry on the work; however, in a disastrous attempt to reach Sabine Pass from the

Mississippi River, this ship was lost in January, 1878. The *Essayons* returned for more dredging, retired for more repairs, and returned again to Sabine Pass in September, 1880.[11]

When the Galveston Engineer Office was established in February, 1880, the Sabine and Neches rivers were placed within its boundaries. In mid-June, 1881, improvement of these waters was assigned to Capt. C. E. L. B. Davis, who at that time transferred out of Galveston. Davis reported directly to the chief of engineers; during the four-month interval of his assignment there, the Sabine River belonged neither to the Galveston nor to the New Orleans office.[12]

Soon after his arrival at Sabine Pass, Captain Davis described problems with the *Essayons*. While conditions at the mouth of the Mississippi River had favored her use there, at Sabine Pass the dredge encountered many problems. Expensive to operate, she would either get stuck in the bottom or caught in crosscurrents and carried across the channel. The most propitious time for her to work was at night. Carefully detailing his reasons, Davis proposed that jetties be constructed and the *Essayons* be laid up at Algiers, Louisiana. To strengthen his recommendation, he added:

> Another reason for laying her up is that her remaining idle here so much of the time has a bad effect upon the people interested in the improvement of this Pass who cannot understand why a boat with such a large crew is not constantly at work.[13]

Although the *Essayons* had received costly repairs before being sent to Sabine Pass in September of 1880, Davis found her debilitated and "liable to become disabled at any moment." Late in July, 1881, he ordered her to cross the bar while she still could and continue on to New Orleans for repairs. In a long letter to the chief of engineers, Davis requested approval for this action, indicating his reasons for avoiding delay and noting, "I find it generally takes about 16 days to get an answer to communications sent to Washington from here."[14]

The Engineer Department appears to have initially authorized preliminary repair work; however, instructions from the chief on September 22 put a halt to further repairs. On October 23, responsibility for the works on the Sabine and Neches rivers reverted to the New Orleans Engineer Office under Capt. William Henry Heuer.[15] Almost forty years would pass before this waterway would be returned to the Galveston District.

The soft mud composing the bar continued to make dredging a losing proposition. Captain Heuer addressed himself to the matter of costly

dredging in a channel that "if left alone, would fill up again." Echoing Davis, he proposed constructing stone and brush jetties, beginning on the west side of the pass. The board of engineers convened in 1882 viewed favorably his proposal, preferring high rather than submerged jetties and omitting openings at the shore end as Heuer had suggested. Contract work on the west jetty began in January of 1883, followed within two years by work on the east jetty. The east jetty was completed to a height of 5 feet above mean low Gulf level and a length of 25,270 feet in March, 1920. The west jetty was completed to a length of 21,860 feet in May, 1929.[16]

Heuer had stated that high jetties placed 1,000 feet apart might afford a depth of 26 or more feet, which "fortunately Sabine Pass does not require . . . ."[17] The future of this waterway and characteristics of the commerce that would later travel over it were still unanticipated in 1896, when it was reported,

> The commerce of the pass at this time is almost altogether in the shipment of pine lumber to coastwise and foreign ports, to wit 45,122 tons valued at $172,681.[18]

The only projection on the horizon was based on completion of two railroads that purported to transform the pass into "a great grain shipping and importing port." One of these roads had already located its terminal point at Port Arthur,

> . . . a part of its plan being to dredge a channel of sufficient depth to permit vessels to come from the pass and land at its wharves.[19]

The Troublesome Canal Permit

In April, 1897, the Kansas City, Pittsburg [sic] and Gulf Railroad together with the Port Arthur Channel and Dock Company began excavating a channel, 25 feet deep by 75 feet wide, along a 7-mile stretch from Sabine Pass to the new city of Port Arthur. The 7 miles from the Gulf to Sabine Pass had already received a $3 million improvement by army engineers, the jetties having produced a channel depth of 25 feet. To connect these waters at Sabine Pass with those of Taylors Bayou at Port Arthur, the Port Arthur Ship Canal was to be dug primarily inland, just inside the west shore of Sabine Lake.

The Port Arthur Channel and Dock Company started dredging operations without securing permission from the War Department, apparently assuming none was necessary. When this deficiency was brought to its

attention, the company promptly requested permission to continue work. The processing of this request had a decidedly informal flavor.

On May 7, 1897, Chief of Engineers Brig. Gen. John M. Wilson wrote the dock company:

> GENTLEMEN: In view of the fact that the Secretary of War has been informed that you propose to construct the canal to Port Arthur entirely inland, he directs me to say that while granting no authority he will no longer prevent the progress of the work, provided no materials are dumped in Sabine Lake nor placed upon the banks where they can be washed into the lake.[20]

On August 30, Wilson indicated this letter constituted his office's "only official record of the action of the Secretary of War in this matter."[21]

An injunction brought against the company in late August, 1897 alleged it had not obtained proper permission. J. McD. Trimble, president of the dock company, wrote Secretary of War Russell A. Alger:

> This allegation you will at once recognize as untrue. You will remember that on the morning of May 14, 1897, as you were about to leave Washington for Philadelphia, . . . you told me that we might be authorized by your permission to connect our canal with the deep water in Sabine Pass, and also in Taylors Bayou. . . .
>
> Afterwards, but on the same day [May 14], I wrote you a letter which you received upon your return from Philadelphia, in which I stated the substance of your said permission and advice. A reference to that letter may serve to refresh your memory in case the flood of subsequent affairs tend to efface your impressions.
>
> . . . I would be obliged if you would give . . . some affirmative evidence of your permit as expressed to me, so that I will not have to depend solely upon my own testimony to establish the fact.[22]

In a terse communication dated September 9, Alger verified the correctness of the permission stated in Trimble's letter of May 14. The status of the law at that time, if anything, fostered the awkward exchanges and ambiguities that accompanied this permit issue.[23]

Historically, under the commerce clause of the Constitution, the federal government claimed the right to assure free navigation in the nation's waterways. At a theoretical level, this claim was acceptable; however, in practice it tended to break down. To what extent could the Corps of Engineers exercise control over navigable waters? When and how could this control be enforced? In the final decade of the nineteenth century, legislation was just being introduced to define more specifically the appropriate role and powers of the Corps in protecting the waterways.

The law under which the Port Arthur company sought permission was contained in section 3 of the 1892 rivers and harbors act, an amendment and reenactment of section 7 in the 1890 act. This legislation made it unlawful to build certain structures that would "obstruct or impair navigation . . ." or to excavate or fill so as "to alter or modify the course, location, condition, or capacity" of any port, harbor, or navigable waters of the United States without approval and authorization from the secretary of war.[24] The people at Sabine Pass, an established settlement dating back to the 1839 "City of the Pass," strongly opposed the canal scheme, contending that sand and silt stirred up by the dredging would travel downstream and impair their harbor. These interests further claimed the secretary of war did not have authority to grant permission for construction of this canal.[25]

For these and possibly for additional reasons related to the nature and magnitude of the canal, Chief of Engineers Wilson questioned whether or not the 1892 law applied in this situation. Was this, he asked, a work which the secretary of war was empowered to authorize? In response, Secretary of War Alger passed the query along to the attorney-general, whose office replied:

> Without assuming to decide whether or not a "canal" is one of the works provided for in section 7, I am of opinion that if it is[,] the Secretary of War has the authority under the act of July 13, 1892, to authorize and permit its construction.[26]

Aside from these legal technicalities, a more practical question pertained to the by-products of the new channel. Concerned parties speculated that the excavated material deposited east of the canal on the shore of Sabine Lake would be vulnerable to extensive erosion. Sabine Pass interests feared this material would be carried down into the pass, where it would clog the channel. Maj. James B. Quinn, who now headed the New Orleans Engineer Office, proposed placing sheet piling on the lake side of the canal, 1,000 feet from its center, to contain the dredged material and thereby safeguard the works at Sabine Pass. Col. (later Brig. Gen.)

Henry M. Robert, Southwest Division engineer, was called in to inspect the works and the plan. Robert reported it "improbable" that the proposed canal, "if properly built, should seriously obstruct or lessen depth of Sabine Pass Harbor."[27]

Plans for the canal were approved by mid-1898. House of Representatives Document 549, Fifty-fifth Congress, Second session, containing the plans submitted by the Kansas City Railroad engineer, constituted the permit for the Port Arthur Ship Canal. The $1,023,982.85 canal was completed in 1899, interestingly enough, the same year Congress legislated strong and precise powers with which the federal government could protect navigable waters.[28]

Oil: A New Dimension

From the time of the first sawmill at Nacogdoches in 1819, milling and exportation of lumber composed the backbone of East Texas economy. After the Civil War, some diversification was introduced and agricultural pursuits on a scale larger than subsistence farming were initiated. Irrigation projects, construction of cottonseed oil mills, and experimental rice farming offered some economic variety, but these innovations were decidedly subordinate to the lumber factor.[29]

An event on a salt dome south of Beaumont dramatically altered the region's economy and changed the course of development along its waterway. For several years, test drilling had been conducted at the Spindletop oil field. On January 10, 1901, the Spindletop well "came in" with a spectacular "gusher" which ran wild for several days before being capped. Along with the petroleum industry blew in a new future for the navigable waters along the Texas Coast.[30]

Located near the site of petroleum production, the Sabine and Neches rivers were destined for rapid and substantial growth to accommodate the new industry. In 1902, Congress provided for preliminary examination of a ship channel from Sabine Pass, connecting with the Port Arthur Canal and continuing along the west shore of Sabine Lake, to the mouths of the Neches and Sabine rivers and on to Beaumont and Orange, respectively. In 1904, the Board of Engineers for Rivers and Harbors determined that a 9-foot deep channel would be adequate. Estimated to cost $536,500, construction would be conditional upon transfer of the Port Arthur Canal to the United States, free rights-of-way along the remainder of the waterway, and provision for early completion under the continuing contract system. The board rejected a 25-foot channel depth, believing that potential commerce in oil, lumber, or other commodities would not benefit "to an extent commensurate with the cost."[31]

The 9-foot Sabine-Neches Canal project was adopted by Congress in 1905. Late that year, owners of the land bordering Sabine Lake offered to donate rights-of-way, provided the channel be constructed inland along the lake shore from the Neches River to Taylors Bayou. While deed transactions were taking place, work began March 1, 1906 at the Sabine River end of the canal, in the lake where no rights-of-way were required. By the end of June, a 20,476-foot distance from the mouth of the Sabine to the mouth of the Neches had been dredged.[32]

The federal government acquired the Port Arthur Canal, lumber basin, turning basin, and a strip of land along the canal, free of cost, under provisions of a congressional act approved June 29, 1906. The secretary of war accepted the deed of conveyance from the Port Arthur Channel and Dock Company on December 13, 1906, making this canal a public water of the United States and a vital link in the Sabine-Neches Waterway. Responsibility for maintaining and operating this property shifted to the Corps of Engineers.[33]

Extension at the southern end of the 9-by-100-foot barge channel to a junction with the Port Arthur Canal was authorized in 1907 and completed the next year. By 1909, commercial growth was so great that interests along the new Sabine-Neches Canal clamored for a 25-foot depth; shippers at Port Arthur and Sabine were pushing for 29 to 30 feet between the jetties.[34]

The Dallas District

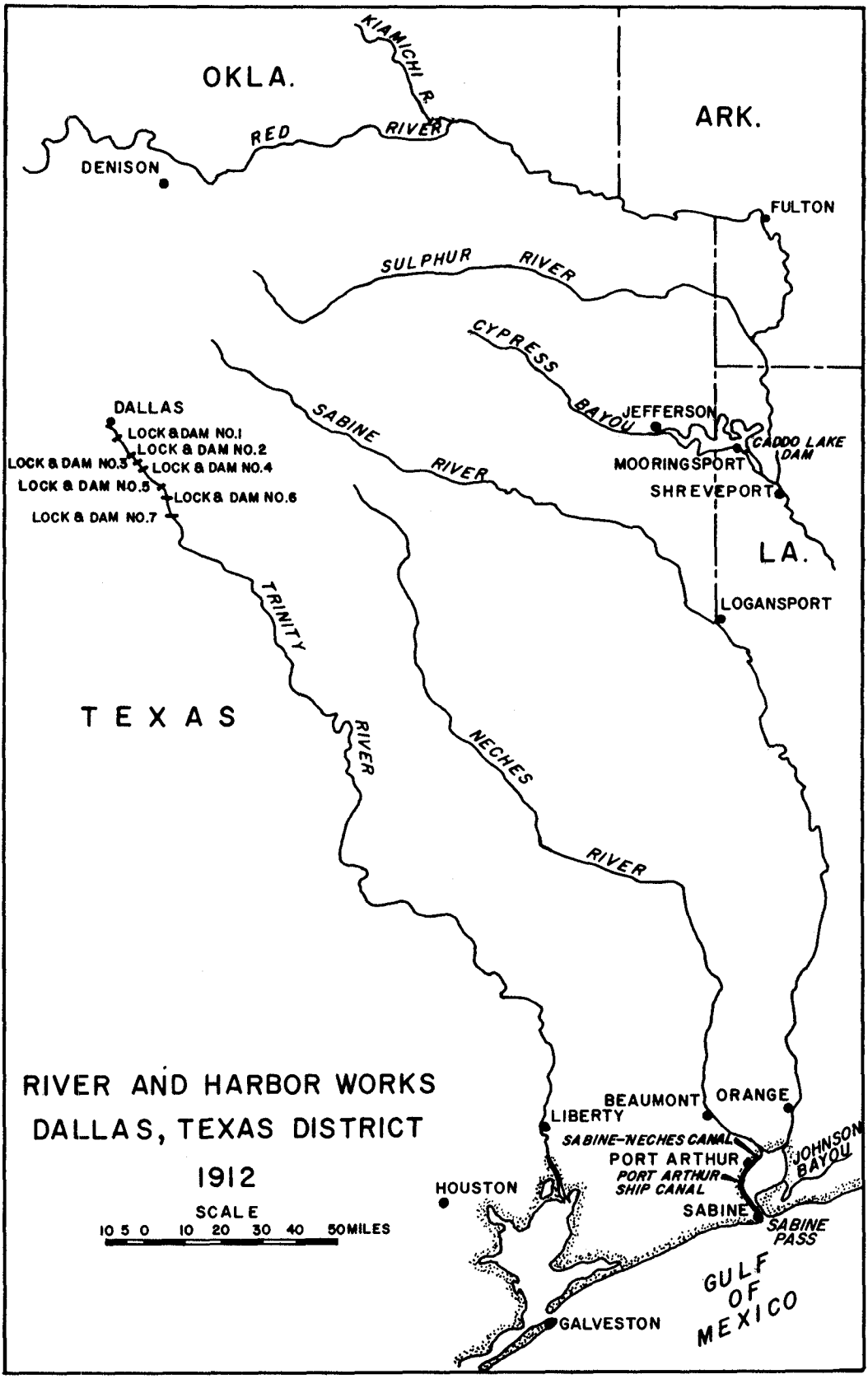
As the waters along Sabine Lake were just beginning their dramatic transformation, an organizational change altered the boundaries of the Galveston District. On August 4, 1905, a second district was established in Texas.[35] The new Dallas District carved its work load out of responsibilities formerly assigned to several older districts, encompassing the Trinity River, Cypress Bayou, and the Red River between Fulton, Arkansas and Denison, Texas, including the Sulphur River. Trinity River was acquired from the Galveston District; the balance of these works was transferred from a district in charge of "improvement of certain rivers and waterways in Louisiana, Texas, Arkansas, Indian Territory, and Mississippi Tributary to Mississippi River."[36] On April 9, 1907, the Brazos River, from Velasco to Waco, was reassigned from Galveston to Dallas. The following year, New Orleans relinquished the Sabine-Neches Waterway.

With acquisition of the Sabine and Neches rivers on April 1, 1908, the Dallas District entered a spectacular era of growth along this waterway. To handle the increased activity upstream, the suboffice moved from

Port Arthur Area Office under construction, 1910

Sabine to Port Arthur. During 1909, the district spent $5,001.62 to construct an office building on the lake side of the Sabine-Neches Canal, opposite Port Arthur.[37] Conditions had indeed changed from those prevailing in 1881, when the New Orleans engineer wrote the chief of engineers:

> General:
>
> The Engineer office at Sabine Pass now consists of two very small rooms for which we are paying $10. per month. I respectfully request authority to pay $5. additional viz $15. in all for the rent of the building. This will give us two additional rooms and control of the building.
>
> We shall then not have any more room than is absolutely necessary.
>
> Very respectfully,
> Your Obd't Servant,
> W. H. Heuer
> Capt. Engrs.


OKLA.
ARK.
KIAMICHI R.
RED RIVER
DENISON
FULTON
SULPHUR RIVER
CYPRESS BAYOU
JEFFERSON
CADDO LAKE DAM
MOORINGSPORT
SHREVEPORT
LA.
SABINE RIVER
DALLAS
LOCK & DAM NO.1
LOCK & DAM NO.2
LOCK & DAM NO.3
LOCK & DAM NO.4
LOCK & DAM NO.5
LOCK & DAM NO.6
LOCK & DAM NO.7
TRINITY RIVER
LOGANSPORT
TEXAS
NECHES RIVER
RIVER AND HARBOR WORKS
DALLAS, TEXAS DISTRICT
1912
SCALE
10 5 0 10 20 30 40 50 MILES
BEAUMONT
ORANGE
LIBERTY
SABINE-NECHES CANAL
PORT ARTHUR
PORT ARTHUR SHIP CANAL
JOHNSON BAYOU
HOUSTON
SABINE
SABINE PASS
GULF OF MEXICO
GALVESTON

Impressive advantages accrued from the improved waterway. From 1908 to 1909, the value of cotton moved through Sabine Harbor doubled and sulphur shipments increased by nearly 25 percent. Accounting for well over half the commercial volume in value, petroleum and its products made up 78 percent of the gross tonnage.[39]

Still, reservations were entertained as to whether future commerce along the Sabine and Neches waters would justify the considerable improvements being sought. By 1909, navigation districts in Beaumont and Orange had set their sights on a channel 25 feet deep. A preliminary examination and survey authorized that year drew unfavorable conclusions on proposed deep-draft improvements above Port Arthur. The rivers and harbors act in 1910 provided for reexamination.[40]

Lt. Col. (later Maj. Gen.) Lansing H. Beach, who had served in Galveston in the early 1890s and would later become chief of engineers, headed a special board of engineers responsible for reconsidering the 25-foot project to Beaumont and Orange. At this point, these two cities were prepared to furnish $571,500, half the estimated expense of $1,143,000. On September 22, 1910, the board held a public hearing in Beaumont.[41]

Perhaps in response to demands of the rapidly growing commercial competition in Texas, Colonel Beach employed a literary analogy to clarify the board's position and explain some economic facts of life to those assembled:

> The United States take care of waterways, but it is in the position of Mr. Wilfer in Dickens' story of our amiable friend. There are so many children to be provided for, that even rich as Uncle Sam is, he does not have money to provide for all of them at the same time. You remember Mr. Wilfer never had a whole suit of clothes at once. He could get a hat at one time, and a pair of shoes at another, and a third time he could get a coat, but there was never money enough to entirely outfit him at one time. Now, of course, you do not see that feature of the case. I think our friend, the Hon. Mr. Burgess, can tell you the demands that are made upon Congress for river and harbor works, and how and why it is necessary for the Government to discriminate. In that connection, I desire the people of Beaumont and Orange to understand the position of engineer officers upon that question. Our action is guided and limited by law. Congress authorizes preliminary examinations and surveys for rivers and harbors that give promise of developing commercial importance, but on account of the great demands of the various rivers and ports, it exacts the condition that

> there shall be either present commerce or prospective commerce sufficient to justify the expenditure.[42]

The Texas Railroad Commission representative described at great length the "Galveston differential," a charge levied on rail traffic moving from the Texas interior to its seaports. Colonel Beach established that extension of deep water inland to Beaumont and Orange would eliminate this differential, thereby reducing freight rates on all commodities.[43]

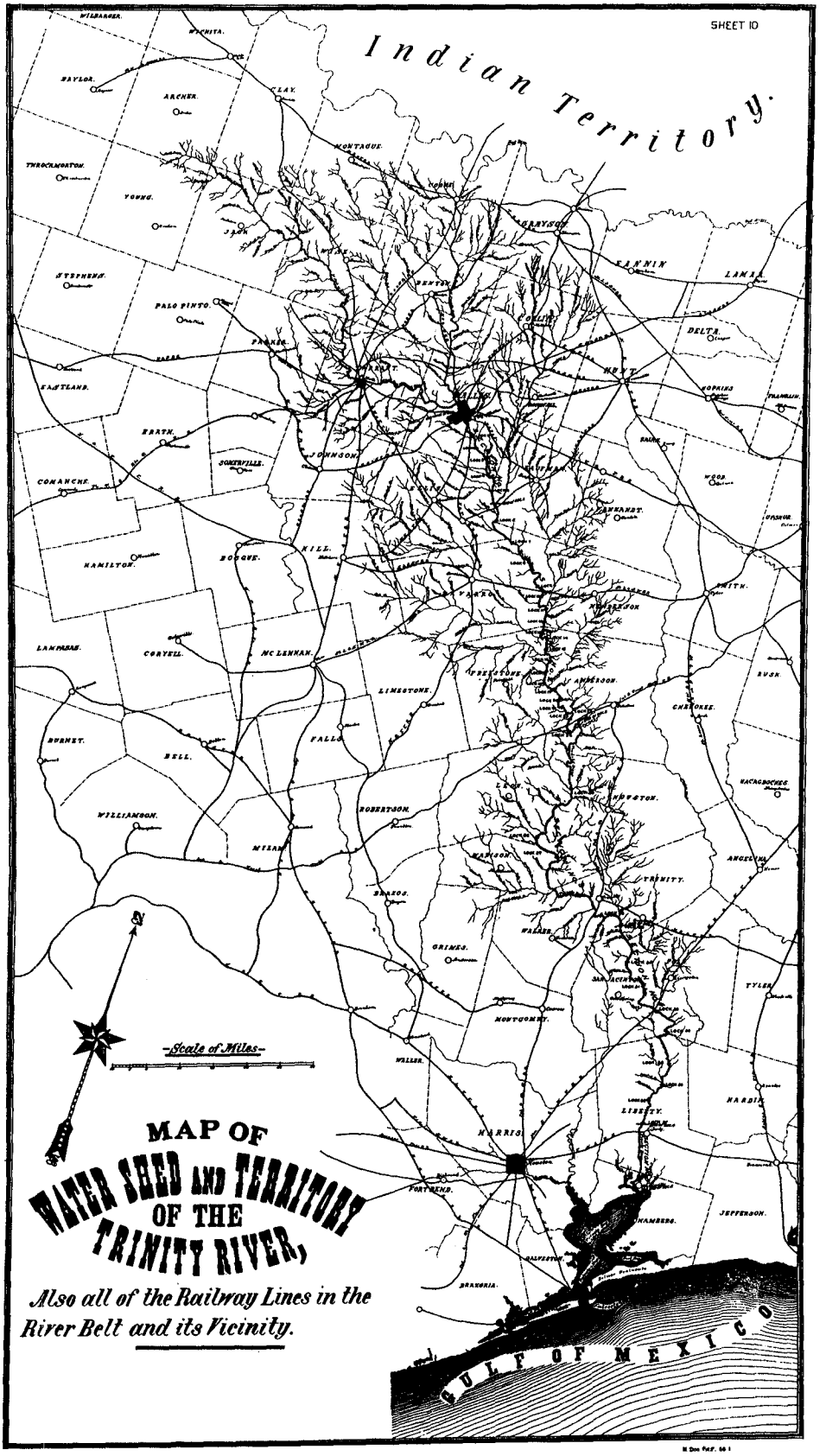
Congress authorized deep water from Port Arthur along the Sabine-Neches Canal and on up the respective rivers to Orange and Beaumont in 1911. Further legislation in 1912 allowed for cutting off bends along the rivers and widening channels. The new, deep-water Sabine-Neches Waterway was completed by 1916. Soon, the "District of Sabine Deep Waterway" (the combined Port Arthur, Beaumont, and Orange navigational interests) ranked first among the nation's oil ports.[44]

Measured by the yardstick of far-reaching results, conversion of the Sabine-Neches Waterway might well be considered the most significant accomplishment of the Dallas District. During its fourteen-year existence, however, this district tackled other ambitious assignments.

One project, adopted in 1902, sought to improve the Trinity River. Formerly, rafting of logs had constituted the only commerce above Liberty, located 41 miles above the mouth of the 760-mile river. Behind the proposed improvement lay hopes of inland planters to gain a water route along which they could move their cotton to Galveston. With the objective of a 6-foot-deep canal extending 511 miles from the river's mouth in Galveston Bay upstream to Dallas, this project called for open-channel work and a system of locks and dams. Initially, thirty-seven locks, with chambers 140 feet long and 50 feet wide, were contemplated; however, by 1918, only nine locks and dams had been covered by specific appropriations.[45]

Work on the first lock and dam began after passage of the rivers and harbors act in 1905 and was completed in 1909, when the army engineers received operation and maintenance responsibility for this and subsequent locks and dams. By 1917, an auxiliary dam had been constructed at Parsons Slough, 22 miles below Dallas, and seven locks and dams had been completed. A contribution of $50,000 from local interests was not forthcoming and the last two of the nine authorized locks and dams were never constructed. Meanwhile the engineers estimated another twenty-seven would be needed to completely canalize the river. Difficulty maintaining

Opposite page: Map of Trinity River, published with 1899 survey report, shows proposed locks and dams.



MAP OF WATER SHED AND TERRITORY OF THE TRINITY RIVER,

Also all of the Railway Lines in the River Belt and its Vicinity.

U.S. snagboat Guadalupe *on Trinity River, 1910*

open-river navigation between the widely separated pools led Congress to abandon the project in 1922, except for the 41 miles from the river mouth to Liberty, which snagging operations had rendered navigable by 1917.[46]

Another major project carried out by the Dallas District involved Cypress Bayou, originally an unnavigable stream, in northeastern Texas and northwestern Louisiana. The mighty Red River "raft" near Shreveport caused water to back into Cypress Bayou, creating lakes and raising the water level until it afforded a navigable route for light-draft steamboats six to nine months of the year. Removal of the raft in 1873, subsequent closure of outlets, and construction of levees down the right bank of the Red River from the hills in Arkansas to near Shreveport cut off the water supply to the lakes. The resulting lowering of the Red River bed prompted quicker drainage; gradually, water depth in the bayou decreased until 1897 when navigation virtually ceased.[47]

To preserve the navigable pool in the upper part of this waterway, between Jefferson, Texas and Mooringsport, Louisiana, the engineers

proposed constructing a dam on Caddo Lake, 2 miles below Mooringsport. They estimated that without this protection, this portion of the bayou would be ruined by the declining water level that had already destroyed navigation on the lower portion of the waterway to Shreveport. The year 1906 showed signs of revived industrial activity in the area: new sawmills going up, older ones increasing their capacities, and large deposits of iron ore near Jefferson to be worked.[48]

Congress authorized the Caddo Lake Dam in 1910. Supported by a pile foundation, the fixed dam extended 3,400 feet in length and assured a 4-foot depth for navigation. By the end of 1914, the Dallas District had completed and taken over operation of the $100,553 structure.[49]

At the time of its abolition, the Dallas District was bounded on the east by the Red River and the Sabine River, on the south by the Gulf of Mexico, on the west by the Brazos River, and on the north by the Red River plus two of its tributaries, the Kiamichi River in Oklahoma and the Little River in Arkansas.[50] In 1919, the Dallas District was dissolved and the bulk of its responsibilities assigned to the Galveston District.

Idiosyncrasies of the Inland Canal

Under these various engineer districts, the Sabine-Neches Waterway developed some features peculiar to its location on Sabine Lake and its inland construction. The first was a guard lock, intended to prevent salt water from traveling upstream. The problem of saline encroachment arose soon after 1900. Before that time, water usage had been moderate, an obstructing bar at the mouth of the Neches River served to contain fresh water, and Sabine Lake functioned as a natural reservoir of fresh water discharged by the rivers. In the mid-to-late 1890s, however, the rice-growing industry entered the scene. About three hundred carloads of rice were shipped down Taylors Bayou during the 1897 season.[51] Within a few years, rice had grown into a booming business.

Not only did the irrigation pumps of the rice growers raise the demand for water, but they also required fresh water. Excessive salinity would injure or even kill a rice crop. A drought in 1901, together with increased drain on the freshwater supply and modifications due to the Port Arthur Canal, caused rice growers along Taylors Bayou to suffer saline contamination of their irrigation water for the first time. By 1902, planters along Taylors and Hillebrandt bayous were calling for a saltwater guard lock in either the Port Arthur Canal or Taylors Bayou. The same year, forecasting problems yet to come, salt water was noted above Beaumont and was reported to have necessitated temporary interruption of pumping at

plants located 7 and 10 miles above the mouth of the Neches River. Oil refineries, just beginning to appear along the waterway, added further demands for fresh water.[52]

Although the 9-foot-deep Sabine-Neches barge canal did not facilitate appreciable movement of seawater into the Neches River, the anticipated effects of a 25-foot channel "turned the tide." The rice growers had become a powerful force to be reckoned with and they were not about to support waterway changes without assurance of adequate protection against saltwater encroachment. Accordingly, they attached a provision to the bond issue for the Beaumont Navigation District's $428,000 contribution to the waterway and installation of a saltwater guard lock became a legal condition of Beaumont's local participation in the deep-water project. Constructed 6 miles above Port Arthur on the Sabine-Neches Canal, the guard lock was transferred to the Beaumont Navigation District for maintenance on June 1, 1916.[53]

The lock hardly proved a navigational asset; on the contrary, it presented just one more problem in a narrow channel with steadily growing commercial usage. While it served to impede passage of salt water up the river, the lock did not absolutely prevent saline intrusion. By 1919, a 30-foot-channel project was in the offing and one consideration was a proposed two-way guard lock. In 1921, army engineers began conducting a comprehensive salinity survey. They concluded, late in 1923, that the original lock should be removed and that the federal government should place no new guard lock in the Sabine-Neches Waterway.[54]

As an obstruction to navigation, the lock was doomed by legislation in 1925.[55] A bypass channel was constructed around it and removal was finally completed during the 1952-53 fiscal year. First of its kind in the district, the guard lock represented an early instance of the Corps's efforts to preserve ecological balance. Years later, the engineers would again direct their energies toward protecting Sabine Lake both from saltwater encroachment and other types of channel pollution.

The "inland" location of the Sabine-Neches Canal created another problem. Before completion of the 9-by-100-foot barge canal in 1908, the city of Port Arthur had fronted on Sabine Lake. The Port Arthur Pleasure Pier Company, a private concern, had installed amusement facilities on the outer end of a wooden pier extending about half a mile into the lake. During the years 1912 to 1914, the company expanded the pier and recreational facilities by constructing a concrete sheet pile enclosure filled with material dredged from Sabine Lake. Construction of the Sabine-Neches Canal had left a number of small tracts of land between the canal

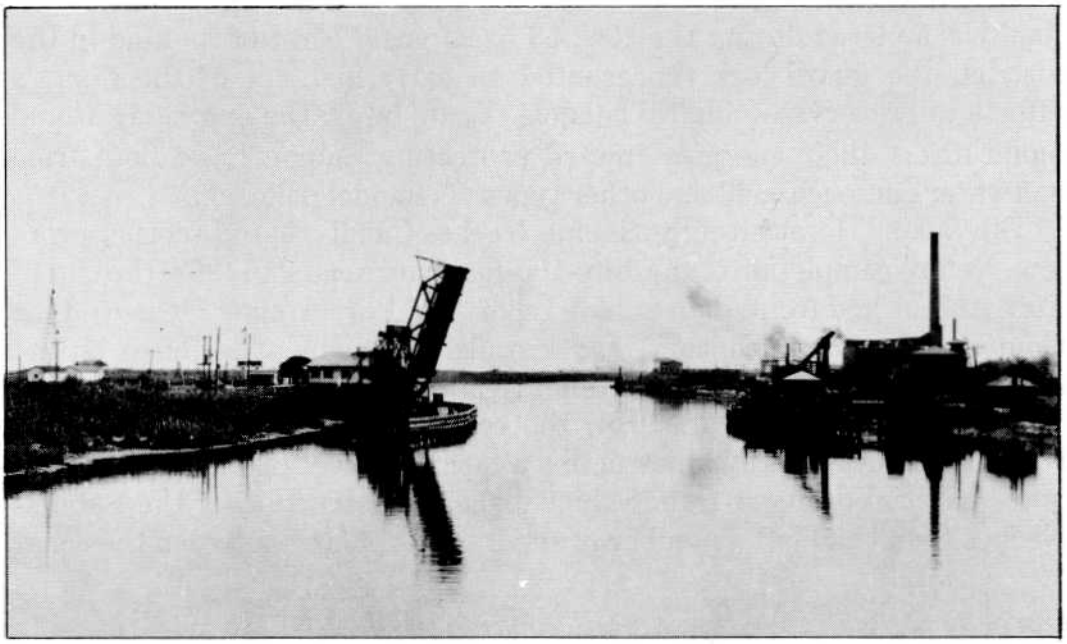
Opposite page: Port Arthur Canal, looking south, 1958

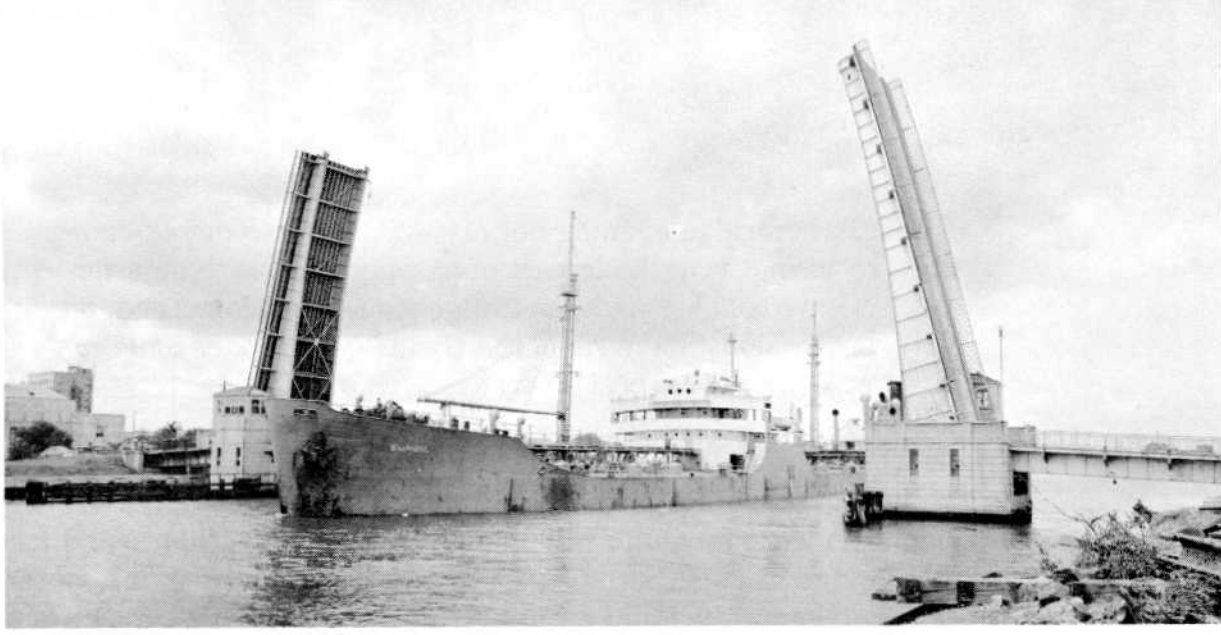
and the lake. This material dredged initially was augmented over the years, eventually resulting in a continuous bank between the canal and the lake that ranged in width from 500 to 2,000 feet. This strip of land was called "Pleasure Island."[56]

To provide access from the city to Pleasure Island, the Pleasure Pier Company built a single-leaf bascule bridge. This structure afforded a 90-foot horizontal clearance across the canal, which meanwhile had been authorized for 25-foot depth. Although plans were approved by the acting secretary of war on September 30, 1912, when the district engineer reported completion of the bridge on April 11, 1914, he noted it to be 1½ feet lower than authorized. Dredged to deep-draft dimensions of 25 feet by 1916, the channel quickly outgrew the bridge, which was taken over by the city of Port Arthur in 1920. When the canal width was increased to 125 feet in 1922, the city added a second short bascule leaf to the east end of the bridge. Later modification of the canal in 1927 provided for a channel 30 feet deep and 150 feet wide. At this point, the bridge was in imminent danger of collapse and the city removed it in 1928.[57]

A new double-leaf bascule bridge, completed by the city in 1931, provided horizontal clearance of 200 feet.[58] All vessels bound for points above Port Arthur were obliged to sail under this bridge. After 1934, barges traveling along the new Gulf Intracoastal Waterway between New Orleans and Galveston further swelled the traffic along this route. As larger

Old bascule bridge, looking south, on Port Arthur Canal, 1925. Port Arthur Field Office appears at left of bridge.





Double-leaf bascule bridge built in 1931 and later extended still made for a "tight squeeze" as larger tankers traveled the Port Arthur Canal.

vessels plied the waterway and the volume of commerce increased, the bridge presented a mounting hazard to navigation.

By 1946, four modifications of the waterway had enlarged the then 36-foot-deep Sabine-Neches Canal to a width of 400 feet, except through a 4,000-foot reach in the vicinity of the bridge. To alleviate the problem of strong tidal currents through this restricted reach, Congress authorized channel enlargement through this stretch to conform to the general project dimensions. Army engineers accomplished eastward extension of the bridge by removing the original 45-foot east approach span and building three new approach spans, each 100 feet long. Completed in 1953, this bridge reconstruction permitted channel dredging below to match canal dimensions overall. The dredging removed the site of the original area office constructed in 1909, necessitating construction of a new building, farther to the east. The 200-foot-wide navigation opening of the bridge was not affected, however, and the main pier supporting the east bascule leaf was situated approximately on the centerline of the 400-foot channel.[59]

Contemplation of a 40-foot canal project depth in 1962 produced this description of the bridge's effect upon navigation:

> Vessel pilots and operators are very reluctant to attempt passing other vessels in the narrow bridge opening. Numerous short delays result from the stopping or slowing of one vessel to await passage through the bridge of another vessel. This practice frequently creates a hazardous condition because of the loss of steerageway by the waiting vessel. It has become virtually impossible to maintain an adequate fender system

> through the bridge opening because of the frequency of damages resulting from the impact of passing vessels. Numerous vessels have collided with the bridge structure proper and, on several occasions, have rendered the movable spans inoperative for periods of several days.[60]

Periods when the bridge was out of service, which on one occasion actually ran into months, not only inconvenienced Port Arthur Area Office personnel who were forced to rely upon boat transportation to and from work; the bridge had also become part of a vehicular route into Louisiana with construction of the Sabine Lake Bridge and Causeway in the early 1950s. Crossing the bridge from Port Arthur to Pleasure Island, running southward down a county road along the canal for about 9 miles, and then traversing the new Sabine Lake Bridge into Cameron Parish, Louisiana, this route offered the only alternative for Corps personnel when water transportation was not accessible. More than once, area office employees had to drive this way into Louisiana, up to Sulphur, back into Texas through Orange, and down to Port Arthur, a distance of 120 miles to get from office to home. Finally, the bascule bridge's location, about two blocks from the business district of Port Arthur, and the large number of tankers carrying volatile petroleum cargoes threatened the heart of the city with the potential for an explosive collision.[61]

A replacement bridge, authorized as part of a 40-foot project for the waterway's inland channels, was to be located about a mile downstream. The old bascule bridge was demolished and removed over a 10-month period ending late in May, 1969, at a cost of $456,000. Construction on the $8.8 million, fixed-span, high-level bridge began in 1967 and was completed in 1970. Extending 5,032 feet from abutment to abutment, the structure provided 400-foot horizontal clearance in the channel under a 664-foot center span with 138-foot vertical clearance. Including the approach ramps brought the overall length to 7,698 feet. The new Gulfgate Bridge at Port Arthur won the Award of Merit from the American Institute of Steel Construction in the 1971 Prize Bridge National Competition.[62]

Another persistent problem was the tendency for material dredged from the landlocked portion of the canal and deposited on Pleasure Island to erode and wash into Sabine Lake. In 1935, modification of the waterway project provided for works to protect the lake against such pollution. Several years later, a 9,350-foot-long pile retaining wall was constructed; however, the area it afforded was soon filled and later developed. Maintenance dredging and periodic channel enlargements continually produced large amounts of material for which new disposal sites were needed.[63]

Northward view of Port Arthur Canal shows new Gulfgate Bridge in foreground (downstream from site of previous bascule bridge) and North Disposal Area in right background.

Eventually, the city of Port Arthur and other recreational interests objected strenuously to further unconfined depositing of dredged matter on the man-made strip of island fronting the lake. Those opposing this practice alleged damage to the sport fishing and recreational potential of Sabine Lake. Consequently, for a time after 1958, the engineers discontinued using Sabine Lake for disposal purposes. Most dumping was done on undeveloped land banks west of the canal. Where this was not possible, such as at Port Arthur, dredged material had to be hauled by hopper dredge to points above or below the city and rehandled by pipeline dredge into dumping areas.[64]

Adoption in 1962 of the 40-foot project for the Sabine-Neches Waterway brought the problem sharply into focus. By 1965, the last of the undeveloped areas along the land side of the channel, between the head of the Port Arthur Canal and a point 2 miles below the mouth of the Neches River, had been lost to industrial and residential development.

Dredging in this 10½-mile reach would involve discharge lines more than 5 miles long. Use of hopper dredges here was also undesirable, both because of their shortage and the hazards of operating such vessels in a narrow channel supporting heavy traffic.[65]

A solution was found by creating two new disposal areas in Sabine Lake, one above and one below Port Arthur. To accommodate dumping needs, projected over a fifty-year period, earthen levees were built into Sabine Lake. Blanket stone covered by riprap protected their outer slopes from erosion. Spillways between interior and exterior levees at either end directed runoff back into the canal. The areas were designed to be built up to a 14-foot elevation. Port Arthur and Beaumont navigation districts participated in the cost to the extent of savings they would realize by being spared construction of retaining dikes, bulkheads, and other embankments at the land areas that would otherwise have been required.[66]

The South Disposal Area, completed May 30, 1969, extended 30,700 linear feet (5.8 miles) along the lakefront, encompassing 3,580 acres. The North Disposal Area, completed September 16, 1969, extended 25,440 feet (4.8 miles) and encompassed 2,220 acres. Twenty-foot-wide, two-lane limestone roadways running along levee crowns were completed in 1974. By constructing these areas, the Corps of Engineers checked the troublesome problem of erosion causing pollution in Sabine Lake, preserved fishing and recreational interests of the vicinity, and provided sites for disposal to serve the Sabine-Neches Canal for the next fifty years.

One other interesting ramification of the 40-foot project involved a 72-mile dredging operation of unprecedented magnitude for the Galveston District. From 1965 until the project's completion in 1972, some 60 million cubic yards of material were dredged from the waterway. Under the previous 36-foot project, the outer bar channel had extended into the Gulf 3½ miles from the ends of the jetties. The new project necessitated dredging an additional 77,734 feet, almost 15 miles, from the end of the old outer bar channel, across an obstructive reef called Sabine Bank, and on out to the 42-foot contour. Half the project's total dredging was conducted in the 21-mile stretch from shoreline out into the Gulf.

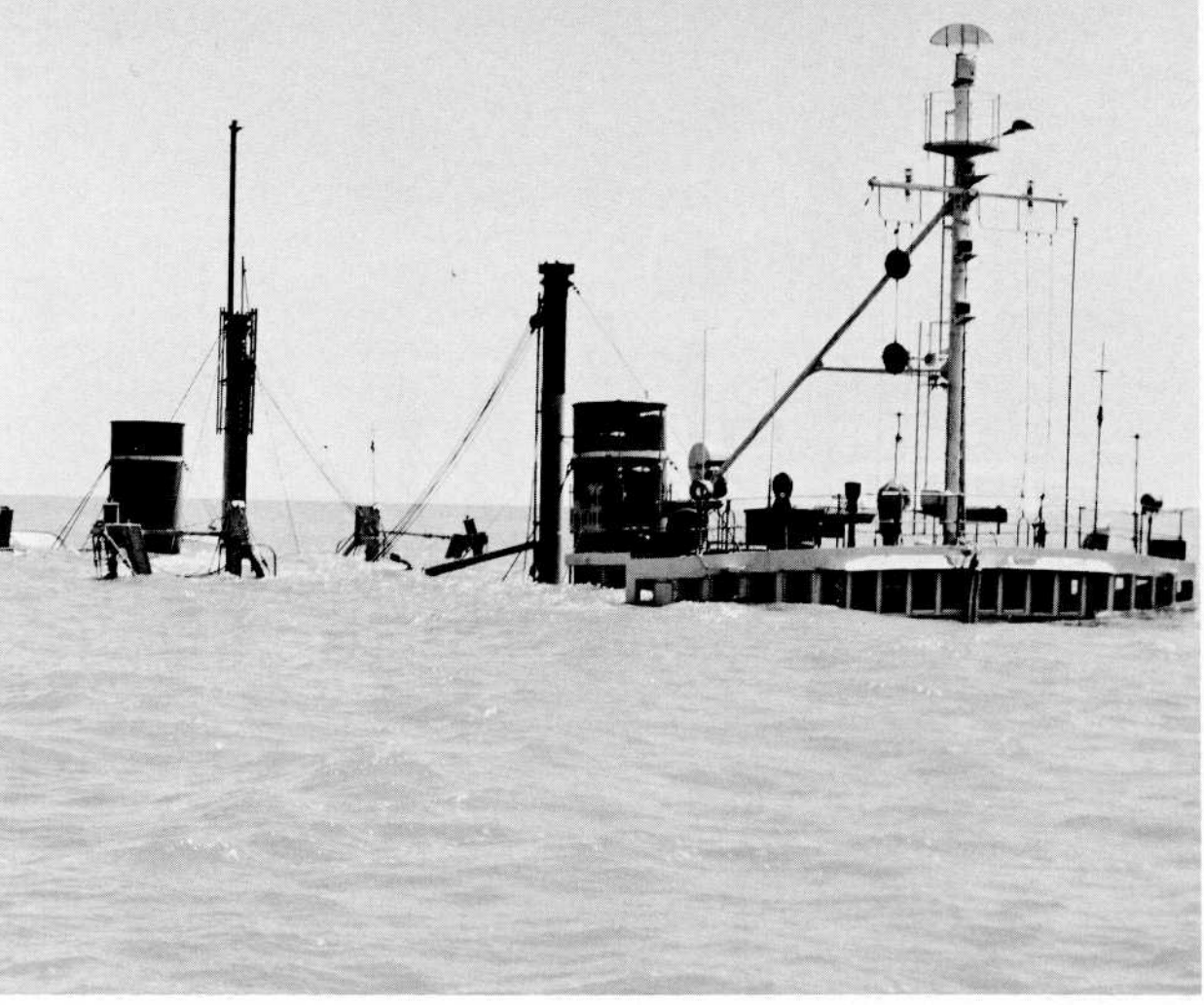
Two government hopper dredges accomplished most of this offshore work. From 1967 to 1974, Galveston District claimed the distinction of operating the oldest and the newest in the Corps's dredging fleet. The oldest, launched in 1924, was named for Maj. Gen. Alexander Mackenzie, chief of engineers from 1904 to 1908. The *Mackenzie* entered war service in August, 1943, when she strapped on two 20-mm. antiaircraft guns and steamed out of San Francisco for Midway Island. There the dredge went to work widening the harbor entrance channel. Among the coral islands

U.S. hopper dredge A. Mackenzie

of the South Pacific, she suffered ravages of enemy attacks and violent typhoons. The *Mackenzie* returned to San Francisco, under tow, early in 1946, patched, battered, and worn. With surplus parts from destroyer escorts, she was overhauled in 1949 and put to work on the Pacific Coast.

The Galveston District intercepted the *Mackenzie* on her way to oblivion. Late in 1951, the dredge was en route to Philadelphia to be scrapped. The Galveston District, dredgeless at that time, managed to obtain the *Mackenzie* temporarily. Utilizing shipyard facilities then available at Fort Point, Galveston personnel gradually revamped the *Mackenzie*, replacing badly worn hopper beams and installing twin rudders to improve her somewhat wanting steering capacity. Eventually, the "old war horse" became attached to the district, where she functioned with outstanding economy for more than twenty additional years. Her riveted, black-painted hull became a familiar sight along the Texas Coast.[67]

On March 6, 1974, the *Mackenzie* celebrated her fiftieth year. Barely a month later, on April 24, a tragic three-way collision, involving a foreign tanker and a smaller research vessel, sent the dredge, busy at work in the



The Mackenzie, *several hours after fatal collision, April 24, 1974*

Galveston Entrance Channel, to the bottom of the channel. Ironically, the dredge, which was struck as the other two vessels tried to avoid hitting each other, was the only one to sustain fatal injury, sinking within a matter of minutes. Although most of her sixty hands were aboard at the time, all managed to escape. The demise of the durable old ship presented a sad epilogue to her long history of productive service.

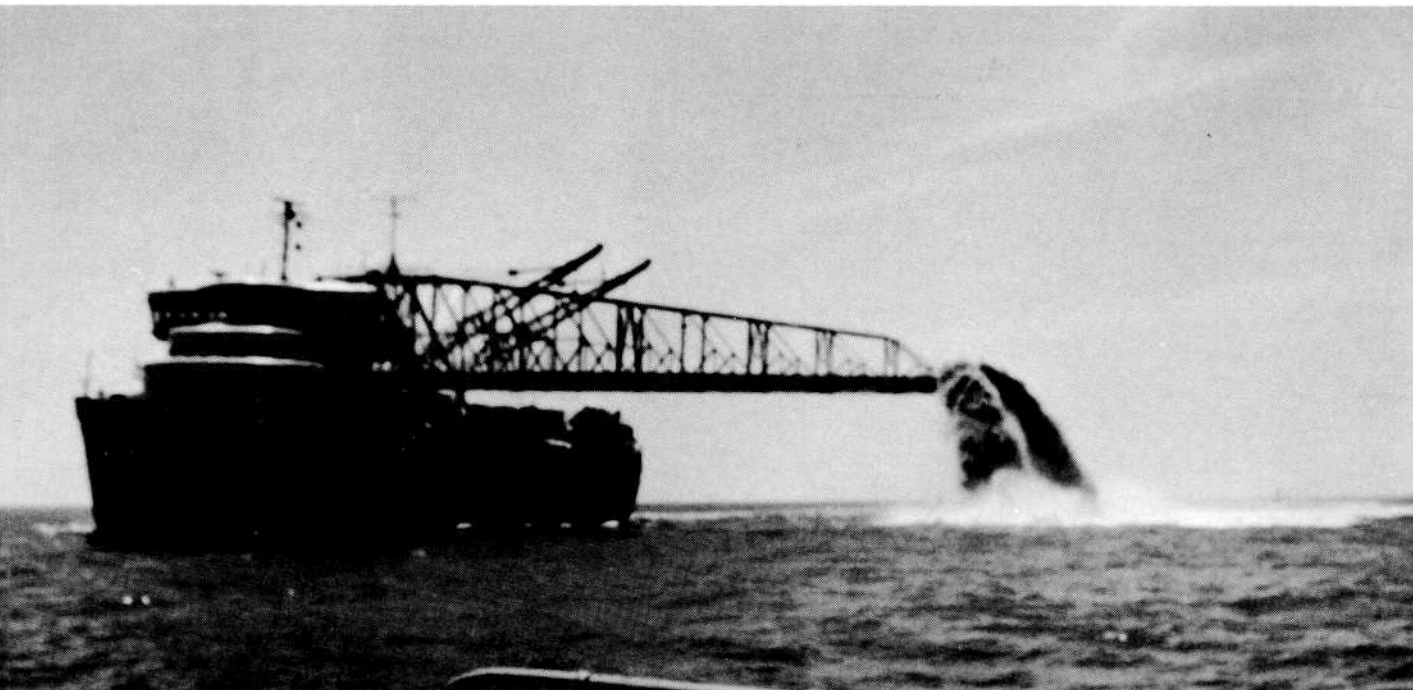
Newest dredge in the Corps's flotilla, the $17 million *McFarland* had worked alongside the *Mackenzie* since April, 1967. Designed with flexibility to accommodate the idiosyncrasies of Sabine Bank Channel, the *McFarland* came equipped with a variety of unique features. Predominant among these ranked her versatility. This single-hopper dredge offered three alternate systems for disposal of dredged material. The traditional method of filling the hopper, hauling the material to a dumping site, and discharging it through gates in the bottom of the hull lent itself to handling the sand and shell reef at Sabine Bank. Closer in toward shore, where the muddy bottom is composed of fine silt carried down by the rivers, the dredge pumped this lighter material directly through a 222-foot-long side-casting boom, removing it from the channel and allowing it to be carried off by the natural currents. A third option, suited to

"beach nourishment" and certain channel conditions, allowed the dredge to connect with a pipeline through which material could be pumped to onshore disposal areas. Many other technical refinements, excellent maneuverability, and sophisticated control devices make the 300-foot-long, 72-foot-wide *McFarland* the most modern hopper dredge in operation by the Corps of Engineers.[68]

On the evening of March 6, 1969, the *McFarland* was unexpectedly pressed into service of a non-dredging nature. As the dredge was working in the Gulf, the officer on watch spotted a shrimp boat that had caught fire about three-quarters of a mile away, just east of the Sabine-Neches Waterway outer bar channel. While contacting the U.S. Coast Guard at Sabine Pass, the dredge crew sped to the blazing shrimp boat. A launch was lowered overboard from the dredge to rescue the boat's two-man crew. Meanwhile, the fire spread rapidly, threatening to produce an explosion when it reached the several gasoline and butane tanks on board. Moving into action, the *McFarland* swung her discharge boom to the side and made five passes by the shrimp boat, pumping clear seawater to quench the fire. By the time the Coast Guard arrived, the fire was under control. Within three hours after sighting the burning vessel, the *McFarland* had returned to her routine duties, opening the waterway to world trade.[69]

The Sabine-Neches Waterway has furnished the vehicle for the phenomenal growth that has characterized the southeastern corner of Texas. Vital commodities, from lumber, grain, and rice to oil and petrochemicals, have moved along its channels and tremendous economic development has flourished along its banks. Through their supporting role of improving and maintaining this essential waterway, Galveston army engineers have

U.S. hopper dredge McFarland *sidecasting in Gulf of Mexico*



contributed substantially to emergence of the thriving Golden Triangle (the industrial complex comprising Beaumont, Orange, and Port Arthur).

Port Arthur acknowledged this contribution by paying tribute to an outstanding civilian employee of the Galveston District. Doris L. Turpin spent more than forty years working in the Port Arthur area. When he retired from his position as Port Arthur area engineer in 1972, the city set aside a day in his honor. "Doris Day" served as a gratifying reminder that indeed the district *is* the men and women who conduct its day-to-day operations.

Notes to Chapter 3

[1] Marilyn McAdams Sibley, *The Port of Houston* (Austin and London: University of Texas Press, 1968), p. 13.

[2] H.R. Ex. Doc. 365, 25th Cong., 2d sess. (1838), p. 2.

[3] *Ibid.*

[4] Texas v. Louisiana, 410 US 704 (1973); Louis J. Wortham, *A History of Texas*, 5 vols. (Fort Worth: Wortham-Molyneaux Co., 1924), 1: 377-78.

[5] S. Doc. 199, 27th Cong., 2d sess. (1842), p. 4.

[6] *Ibid.*, pp. 7-8, 14, 25, 74.

[7] *Houston Post*, 23 June 1974; Texas v. Louisiana, 410 US 705-07 (1973).

[8] Texas v. Louisiana, 410 US 702 (1973).

[9] S. Ex. Doc. 1, 33d Cong., 1st sess. (1853-54), 2: 552-59.

[10] *Ibid.*, pp. 558-59.

[11] *Annual Report of the Chief of Engineers to the Secretary of War for the Year 1873* (Washington, D.C.: Government Printing Office, 1873), p. 684 (hereafter cited as *ARCE*, followed by date of fiscal year covered in report); *ARCE, 1875*, pp. 947-48; H.R. Ex. Doc. 147, 47th Cong., 1st sess. (1882), pp. 3-4.

[12] *ARCE, 1881*, pp. 1322, 1324-25; Adjutant General's Office, Special Order 120, 26 May 1881; Captain Davis had charge of these improvements from 13 June to 23 October 1881.

[13] Capt. Davis to Brig. Gen. H. G. Wright, Chief of Engineers, 24 June 1881, Galveston District Installation Historical Files (GDIHF).

[14] Davis to Wright, 2 August 1881, GDIHF.

[15] *ARCE, 1882*, p. 195.

[16] H.R. Ex. Doc. 147, 47th Cong., 1st sess. (1882), pp. 7, 12-13; *ARCE, 1920*, p. 1101; *ARCE, 1929*, p. 952.

[17] H.R. Ex. Doc. 147, 47th Cong., 1st sess. (1882), p. 8.

[18] *ARCE, 1896*, p. 1514.

[19] *Ibid.*

[20] H.R. Doc. 549, 55th Cong., 2d sess. (1898), p. 14.

[21] *Ibid.*, p. 15.

[22] *Ibid.*, pp. 14-15.

[23] *Ibid.*, pp. 15-16.

[24] *Ibid.*, p. 11; Rivers and Harbors Act of September 19, 1890, ch. 907, 26 Stat. 426; Rivers and Harbors Act of July 13, 1892, ch. 158, 27 Stat. 88.

[25] H.R. Doc. 549, 55th Cong., 2d sess. (1898), pp. 10-11.

[26] *Ibid.*, pp. 9-13.

[27] *Ibid.*, pp. 10-11, 41.

[28] H.R. Doc. 975, 66th Cong., 3d sess. (1920), p. 17; Rivers and Harbors Act of March 3, 1899, 33 U.S.C. §§ 401-418 (1970).

[29] Paul R. McGuff and Wayne Roberson, *Lower Sabine and Neches Rivers, Texas and Louisiana: A Study of the Prehistoric and Historic Resources in Areas under Investigation for Navigation Improvement*, Texas Archeological Survey, Research Report no. 46 (Austin: University of Texas, 1974), pp. 34, 38.

[30] *Ibid.*, p. 39.

[31] Rivers and Harbors Act of June 13, 1902, ch. 1079, 32 Stat. 331; The five-man Board of Engineers for Rivers and Harbors was established under section 3 of the Rivers and Harbors Act of June 13, 1902; H.R. Doc. 634, 58th Cong., 2d sess. (1904), pp. 2-3, 16.

[32] Rivers and Harbors Act of March 3, 1905, ch. 1482, 33 Stat. 1117; *ARCE, 1906*, p. 1320.

[33] *ARCE, 1908*, pp. 476-77.

[34] Rivers and Harbors Act of March 2, 1907, ch. 2509, 34 Stat. 1073; H.R. Comm. Doc. 50, 61st Cong., 2d sess. (1909), pp. 2-3.

[35] In 1903, two recent graduates of the University of Texas, Nathaniel T. Blackburn and Richard B. Gillette, joined the Galveston District. When the Dallas District was formed, Gillette was assigned to carry the records to the new district. He remained with the Dallas District until its abolition, returning to Galveston where he completed more than forty years of service to the Corps. Blackburn stayed in Galveston, working for the district until the early 1930s. When he died in 1967, he left a bequest of over $1 million to the National Audubon Society.

[36] *ARCE, 1905*, p. 399.

[37] *ARCE, 1909*, p. 1526.

[38] Capt. Heuer to Chief of Engineers, 31 October 1881, GDIHF.

[39] H.R. Doc. 773, 61st Cong., 2d sess. (1910), pp. 14, 17-18.

[40] H.R. Doc. 836, 61st Cong., 2d sess. (1910), p. 3; Rivers and Harbors Act of June 25, 1910, ch. 382, 36 Stat. 630.

[41] H.R. Doc. 1290, 61st Cong., 3d sess. (1911), pp. 2-4.

[42] *Ibid.*, p. 27.

[43] *Ibid.*, pp. 10, 12, 15, 19. Railroad rates regulated by the commission were based on the shortest distance from point of origin to deep water. The "differential," equivalent to the Direct Navigation Company's water rate between Houston and Galveston, applied to goods moving by rail from Houston to deep water at Galveston as well as from Beaumont and Orange to the seaport at Port Arthur. For example, on 100 pounds of cotton, the differential amounted to an additional six cents over the fixed forty-five-cent rate to Houston, Beaumont, or Orange. Establishing deep-water ports at Beaumont and Orange (or for that matter any other inland port to which seagoing vessels could proceed without breaking cargo) would result in abolition of the differential and increased competition among Texas ports.

[44] Rivers and Harbors Act of February 27, 1911, ch. 166, 36 Stat. 933; Rivers and Harbors Act of July 25, 1912, ch. 253, 37 Stat. 201; H.R. Doc. 975, 66th Cong., 3d sess. (1920), pp. 16, 20.

[45] Rivers and Harbors Act of June 13, 1902, ch. 1079, 32 Stat. 331; H.R. Doc. 409, 56th Cong., 1st sess. (1900); *ARCE, 1913*, p. 824; *ARCE, 1918*, p. 1070.

[46] Rivers and Harbors Act of March 3, 1909, ch. 264, §6, 35 Stat. 815; *ARCE, 1920*, p. 1115; H. R. Doc. 989, 66th Cong., 3d sess. (1921), p. 27; *ARCE, 1922*, p. 1144.

[47] *ARCE, 1918*, p. 1083.

[48] H.R. Doc. 220, 60th Cong., 1st sess. (1907), pp. 4-5.

[49] Rivers and Harbors Act of June 25, 1910, ch. 382, 36 Stat. 630; *ARCE, 1915*, pp. 945, 947; The dam was built with the idea of later installing a lock should circumstances justify reopening navigation in the reach below the dam to Shreveport. Subsequent studies for such a lock, conducted in 1913, produced unfavorable reports, however, and the additional work was not undertaken. H.R. Doc. 236, 63d Cong., 1st sess. (1913), p. 6.

[50] *ARCE, 1918*, p. 1057.

[51] H.R. Doc. 549, 55th Cong., 2d sess. (1898), p. 20.

[52] *Interim Review of Reports on Neches River and Tributaries, Texas Covering Salt Water Barrier at Beaumont, Texas* (Galveston: U.S. Army Engineer District, 1973), p. C-10; H.R. Doc. 634, 58th Cong., 2d sess. (1904), pp. 8, 12.

[53] *Salt Water Barrier*, p. C-11; Dimensions of this first attempt to prevent saltwater intrusions were 80 feet in width, 646 feet in length between miter sills, and 28 feet in depth over the miter sills at mean low Gulf level. H.R. Doc. 975, 66th Cong., 3d sess. (1920), p. 5.

[54] H.R. Doc. 975, 66th Cong., 3d sess. (1920), p. 29; H.R. Doc. 234, 68th Cong., 1st sess. (1924), pp. 5, 24.

[55] Rivers and Harbors Act of March 3, 1925, ch. 467, 43 Stat. 1186.

[56] Disposition Form, Galveston District to Southwestern Division Engineer, 23 October 1961, "Request for Approval of Proposed Apportionment of Cost of Relocation of Pleasure Pier Bridge at Port Arthur, Texas," no. SWNGW-la, GDIHF (hereafter cited as DF, "Pleasure Pier Bridge").

[57] H.R. Doc. 975, 66th Cong., 3d sess. (1920), pp. 45-46; DF, "Pleasure Pier Bridge."

[58] DF, "Pleasure Pier Bridge."

[59] Rivers and Harbors Act of May 17, 1950, ch. 188, 64 Stat. 163; DF, "Pleasure Pier Bridge."

[60] H.R. Doc. 553, 87th Cong., 2d sess. (1962), p. 50.

[61] DF, "Pleasure Pier Bridge."

[62] Rivers and Harbors Act of October 23, 1962, Pub. L. No. 87-874, 76 Stat. 1173; *ARCE, 1969*, p. 483; The bridge was designed by the consulting firm of Modjeski and Masters.

[63] Memo, Col. John E. Unverferth, Galveston District Engineer, to Southwestern Division Engineer, 2 March 1965, "Spoil Disposal — Sabine-Neches Waterway," GDIHF.

[64] *Ibid.*

[65] *Ibid.*

[66] *Ibid.*

[67] Capt. Kelly F. O'Neal served as master of the *Mackenzie* from 1952 to 1967. He assumed this command after an unusual tour of duty with another of Galveston District's veteran dredges. Plans called for the *Manhattan* to be taken out of storage in Philadelphia and given to Thailand. O'Neal and a number of the former crew members signed up to deliver their old dredge and train a Siamese crew to take over its operation, arriving in Bangkok late in June, 1951. The Thai government had planned elaborate ceremonies to receive the vessel. Buddhist priests blessed the *Manhattan* and officials boarded the flower-decked dredge, when the festivities were interrupted by a full-blown political revolution. After some harrowing experiences, O'Neal and his men spent four months in Thailand completing their mission before they returned safely home.

[68] The vessel commemorates Arthur McFarland, who directed design, construction, and maintenance of dredging plant in Galveston from 1927 to 1935 and completed his distinguished career in charge of nationwide dredging operations in the Office of the Chief of Engineers. Late in 1976, the *McFarland* was transferred to the Jacksonville District in exchange for the *Gerig*.

[69] *Galveston Daily News*, 21 March 1969.